PUBLIC ATTITUDES, EPIDEMIOLOGY AND CONSEQUENCES OF DRINKING AND DRIVING IN BRITISH COLUMBIA

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(Received February 1, 2006)

Injury is the ninth most common cause of premature death worldwide and the third most common cause of years lived with disability. Many early deaths are related to motor vehicle crashes (MVC's): each year, MVC's kill 1.2 million people (3,242 deaths/day) and injure or disable 20-50 million more. The Global Burden of Disease Study, conducted in the early 1990s, predicted that traffic-related injuries will become the third largest contributor to global death and disability by the year 2020. The identification of effective strategies for the prevention of traffic related injuries is of global health importance. The substantial effect of alcohol on road safety has long been recognized, and a variety of important initiatives to combat this problem have been introduced with some measurable success. Canadians have rated drinking and driving as one of the most important social issues facing them today, placing it ahead of other prominent issues, including health care, pollution, and the state of the economy. Two factors that have contributed strongly to motor vehicle injuries and fatalities in British Columbia (BC) and Canada are alcohol-impaired driving and failure to use seat belts. Drivers who operated motor vehicles after drinking were less likely to wear seat belts, and so they continue to be a major traffic safety concern. When compared to restrained occupants, unrestrained occupants were almost 5 times more likely to die (Odds Ratios (OR) 4.70), or be injured (OR 4.66). Fractures (OR 10.70, 95% confidence intervals [CI] 7.35-15.5), lacerations (OR 7.50, CI 5.55-10.15) bleeding (OR 7.14, CI 4.97-10.26) and concussions (OR 5.49, CI 2.71-11.12), were the more common types of injuries experienced by unrestrained occupants compared to the restrained occupants. Laws mandate the use of safety belts by motor vehicle occupants, and driving under the influence of alcohol is a generic term for a series of offences under the Canadian Criminal Code. Violation of Road Traffic Laws continues to be a serious 'social problem' and can often have fatal consequences as demonstrated in this study.

Key Words: Public attitudes, Causes of fatal and serious injury, Risk taking behavior, Driving under influence (DUI), Restraint use

1. INTRODUCTION

Injuries are a significant global public health burden. During the year 2000, an estimated five million people worldwide died from injuries, accounting for 9% of deaths and 12% of the burden of disease. The burden is predicted to get worse and by the year 2020, it is estimated that deaths from injuries will increase to 8.4 million per year. Injuries rank among the leading causes of mortality and burden of disease in all regions, affecting people of all ages and income groups[1]. MVC's are a significant contributor to the burden of injury and deaths worldwide. Risky driving behaviors, such as drinking and driving, speeding and the non-use of seatbelts, are considered responsible for a significant proportion of this global burden[2].

Presently, Canada ranks eighth among selected member countries of the Organization for Economic Co-operation and Development (OECD) when comparisons are made on the number deaths per kilometer traveled. While many advances have been made in road safety in Canada, motor vehicle crashes remain the seventh leading cause of potential years of life lost (PYLL), and among those aged 0-19, MVC's are the third leading cause of PYLL[3]. The substantial effect of alcohol on road safety has long been recognized, and a variety of important initiatives to combat this problem have been introduced with some measurable success[4]. Since motor vehicle crash-related injuries are a major cause of death, disability, and PYLL, the prevention of motor vehicle

crash-related injuries would seem to be a particularly important priority for policy makers, health care professionals, and insurance companies, all of whom are challenged to maximize the efficiency of dollars spent in health care.

Injury is the leading cause of death and hospitalization for children, youth and adults (to age 44) in BC. Motor vehicle crashes are responsible for the majority of these deaths, and alcohol is a persistent factor in these crashes. Much research has confirmed the association of alcohol use and the risk of being involved in a traffic collision. Consuming as little as 2 alcoholic beverages increases the risk of an injury, and the risk rises exponentially with consumption above that amount[4]. Although moderate drinking may not cause a person's blood alcohol concentration (BAC)* to exceed the legal limit for driving, moderate drinking increases the risk of being involved in a fatal crash. Compared with drivers who have not consumed alcohol, drivers with BAC between 0.02 and 0.04% are 1.4 times more likely to be involved in a single-vehicle fatal crash. Furthermore, this risk increases to an estimated 11.1 times higher for drivers with BACs between 0.05 and 0.09%, 48 times higher for drivers with BACs between 0.10 and 0.14%, and 380 times higher for drivers with BACs at or above 0.15%[5].

Epidemiological studies have consistently reported that the risk of injury increases with BAC[6-9]. What is considered by many to be non-hazardous alcohol consumption has been shown to be associated with injury. The potential benefits to individuals and society from preventing these injuries are considerable[10]. Alcohol-related motor vehicle crashes represent a leading cause of morbidity and mortality, particularly in young people, carrying an immeasurable human cost, as well as an enormous burden to society. Over the past decade, the number of deaths from road traffic crashes in BC has continued to fall. However, the overall number of traffic crashes and casualties increased in 2003. In that year, there were 443 reported road traffic deaths compared to 467 in 2002. During the same period, total casualties rose slightly from 29,839 to 31,135, and the total number of reported traffic crashes increased from 41,512 to 43,658. Despite improvements, drinking and driving remains an important factor in the overall traffic crash problem. In 2003, drinking and driving crashes contributed to 23.5% of all fatal crashes and 11% of all injury-related crashes in BC.

1.1 Risk of mortality and morbidity among non users of seat belts in BC

While safety belts may be installed in vehicles, crash protection comes only from their active use by drivers and passengers; and while population safety belt usage rates have risen dramatically with the passage of mandatory safety belt laws in 1977, the Insurance Corporation of British Columbia (ICBC) motor vehicle crash data (2003) reported that of the victims killed in passenger cars, 41% were unrestrained, and of the victims killed in light trucks, 56.8% were unrestrained. Similarly in 2003, 83.6% of the drivers involved in casualty collisions who did not use restraints were either injured or killed, while 51.6 of those who did use the standard lap and harness restraint system were either injured or killed. Data on occupants ejected from vehicles demonstrate that ejection carries a very high risk of injury or death. Among those drivers who were ejected or partially ejected, 16.2% were killed and another 76.8% were injured. Similarly, 12.5% of passengers who were ejected or partially ejected were killed and 81.2% were injured.

1.2 Effectiveness of seat belts

Most Canadians believe that the use of seat belt reduces the risk of death and injury; yet, almost 40% of motor vehicle occupants who died were not wearing a seat belt at the time of the collision. Among those seriously injured, 20% were not wearing a seat belt[11]. Seat belts have been clearly shown to reduce overall mortality and morbidity in automobile crashes[11-19]. Wearing a shoulder and lap restraint significantly reduces the risk of severe injury and death for drivers, front seat passengers, and rear seat passengers[11], particularly for children[11,12]. The National Highway and Traffic Safety Administration (NHTSA) estimates that shoulder and lap belt use in automobiles reduces the risk of death by 45%, and the risk of severe injury by 50%, while their use in light trucks lowers the risk of death by 60% and severe injury by 65%[15]. In comparison, air bags reduce the risk of death by only 12%[12-15,]. Seat belt use has also been shown to decrease medical costs associated with motor vehicle crash-related injuries[12,13] and it has been estimated that over 26 billion dollars could be saved each year if seat belt use were universal[14,15].

Two factors that have contributed strongly to motor

* Blood alcohol concentration (BAC) and refers to the weight of alcohol (expressed in milligrams) in a standard volume of blood (usually 100 milliliters). It is an offence under the Criminal Code in Canada to operate a motor vehicle with a BAC that exceeds 80 milligrams of alcohol per 100 milliliters of blood. Because the amount of alcohol in the breath is directly proportional to the amount of alcohol in the blood, BAC is readily (and most often) measured by means of a breath test - i.e., a "breathalyzer".

vehicle injuries and fatalities in BC and Canada are alcohol-impaired driving and failure to use seat belts. While all provinces in Canada have made substantial efforts to decrease alcohol-impaired driving and increase seat belt use rates, they have taken somewhat different paths in addressing these common problems, with differing results. For example, Transport Canada's 2001 national survey suggests that Canada's seat belt wearing rates for all occupants of light-duty vehicles have remained unchanged for the last 3 years, at 90%. Although 5 Canadian provinces have seat belt wearing rates exceeding 90%, only BC and the 3 Territories have rates below 85%. Thus, in the Canadian context, the rate of wearing seat belts in BC is low. Peek-Asa and Kraus[20] found that alcohol-impaired drivers were more likely to be speeding and less likely to be wearing safety restraints in the event of a crash. Similarly, Jonah[21] and Shinar et al.[22], have noted that failure to wear a seat belt is often associated with other 'deviant' behaviors such as drug use and drinking and driving.

It is evident that in order to further efficient and effective traffic safety measures, there is a need for increased research on current road safety efforts, particularly the factors related to fatal and serious injury collisions, including the need for improved data systems in order to monitor progress and improved safety. The findings of this study are useful, not only in estimating the magnitude of the non-compliance problem related to fatal and injury risks, but also in developing the understanding of seat belt wearing behavior in alcohol impaired drivers in BC.

2. OBJECTIVES

The objectives of this study are to:

(1) Review the epidemiology of crash occurrence in BC/Canada
(2) Examine driver and passenger fatalities and injuries in drinking and driving motor vehicle crashes, and estimate the risk of non seat belt use in injuries and fatalities
(3) Review public attitudes about alcohol impaired driving in BC/Canada

Recognition of the association between alcohol and injury is important, not only for proper care and treatment of the underlying problem, but in order to stimulate enactment of preventive measures aimed at reducing the risk of drinking and driving-associated motor vehicle injuries and fatalities.

3. DATA AND METHOD

BC's traffic accident system accumulates and maintains information on all reported traffic collisions occurring throughout the province. Annual crash data were obtained from ICBC[23]. The database contains information on personal factors: injury type and anatomical site injured for each person, restraint use, as well as the information on vehicle damage severity, time of the crash, road conditions and cause of crash, and crash characteristics. The data includes several variables regarding the use and availability of restraint systems within each vehicle for each occupant. Manual (or active) belt use is defined as the use of shoulder belt, lap belt, lap and shoulder belt, or any combination of belt use with a child safety seat. Alcohol-related injury data used in this study included all crashes resulting in injury not just serious ones, as information on injury severity resulting from a crash is not recorded by the police in BC. Police reports describe the type of crash, the characteristics of each vehicle, and information about injuries, if any, to each occupant of each vehicle. For all occupants, police specify what appears to be the most important injury, the location (head, abdomen etc.) and the nature of the injury (concussion, laceration, fracture etc.).

Chi-square tests (or Fisher's exact tests when expected frequencies were below 5) were performed to compare the significance of any differences ($p < 0.05$) in demographic risk factors of alcohol-related crashes. OR and 95% CI are used to analyze the risk of non use of seat belt. The OR indicates the risk of fatal injury while drinking and driving and being properly restrained, compared to the risk while drinking and driving and being unrestrained.

4. RESULTS

4.1 Public attitudes on alcohol impaired driving in BC/Canada

Eighty-one percent of Canadians have rated drinking and driving as one of the most important social issues facing them today, placing it ahead of other prominent issues, including health care, pollution, and the state of the economy[24]. There is evidence, however, that public attitudes about impaired driving in BC have not kept pace with those in other jurisdictions. Although 80% of British Columbians identified drinking and driving as a serious problem in a 2002 survey, that number is lower than Ontario (86%) and Quebec (99%). In the same survey,

11.3% of BC drivers reported driving while feeling impaired at least once in the past two months - in Ontario this group represented 5.4%. Using this survey data, it was estimated that there were approximately 2.5 million self-reported episodes of driving while impaired (DWI) in 2002[25].

The incidence and rate of DWI reported in this survey are probably underestimates for several reasons. Firstly, individuals may be reluctant to admit to DWI because this behavior carries a social stigma and can be illegal. Secondly, because respondents were asked to report "driving after having had, perhaps, too much to drink," some may have denied being impaired after drinking episodes. Thirdly, this survey did not include data from drivers aged <19 years, and DWI occurs frequently in this group. However, the Adolescent Health Survey[26], found that heavy drinking is becoming more common among BC youth. Of high school students who drink, the rate of binge drinking in the previous month increased from 36% in 1992 to 44% in 1998. Binge drinking often defined for males as having 5 or more drinks in one sitting and for females as having 4 or more drinks in one sitting is reportedly widespread among adolescents in BC.

4.2 Driver age gender

The mean age for drivers was 34.31 years (15-88 yr; S.D. 13.45) for alcohol-related motor vehicle crashes in 2003. Of all drivers with alcohol as a factor involved in Police-attended casualty collisions, 79.3% were male. With respect to age, 7% of the alcohol-involved drivers were under the legal drinking age of 19. In 2003, 89.4% of drivers killed and 79% injured in alcohol-related crashes were male.

4.3 Time of occurrence

According to Figure 1, alcohol-related casualty collisions were more likely to occur on weekends (Friday, Saturday and Sunday) than on weekdays. In 2003, approximately 61% of all alcohol-related injury collisions occurred on weekends. Likewise, 63.4% of all alcohol-related fatal crashes occurred on weekends. The peak occurrence for alcohol-related injury crashes was between 9:00 p.m. and 3:00 a.m., with the peak of alcohol-related fatal crashes occurring between 11:00 p.m. and 12:00 a.m. (Figure 2).

4.4 Risk of injuries, fatalities and non restraint use

Drivers who operated motor vehicles after drinking were less likely to wear seat belts. Table 1 illustrates that the risk of a fatality is 4.70 times higher among unre-

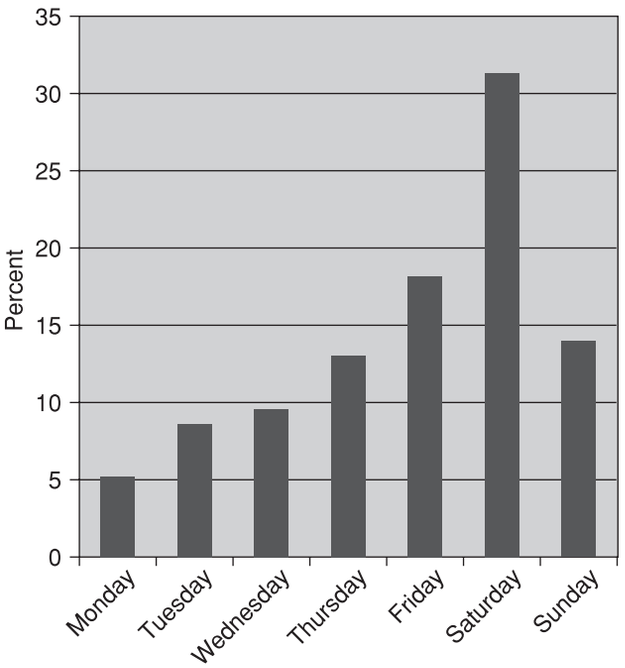

Fig. 1 Drinking driving involved fatal traffic crashes, by day of the week (in percent)

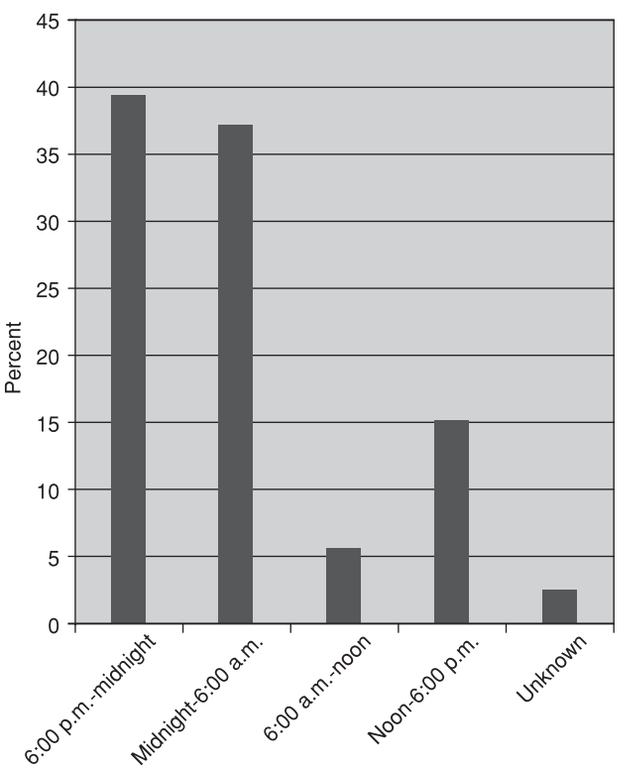

Fig. 2 Drinking driving involved fatal traffic crashes, by time of day (in percent)

strained occupants.

As shown in the Table 2, young drivers are over-represented in alcohol-related traffic crashes, and this group continues to be a major traffic safety concern. In 2003, according to the ICBC motor vehicle crash data, drivers aged 16-20 years comprised only 6.62% of licensed drivers, but accounted for 17.30% of alcohol-related collisions in the province. Similarly, drivers aged 21-25 years comprised only 7.92% of licensed drivers, but accounted for 20.64% of alcohol related collisions in BC.

Table 3 shows that young drivers are over-represented in alcohol related traffic fatalities in BC. Drivers aged 16-20 years comprised only 6.62% of licensed drivers, but accounted for 15.70% of alcohol related fatal collisions and 12% of non alcohol fatal collisions in the province. Thus, they continue to be a major traffic safety concern. According to our data we can conclude that despite improvements in the 1990's, highway crashes among young drivers, including alcohol-related crashes, continue to be a serious and persistent problem in BC. Several factors contribute to the increased risk of traffic crash-related fatalities among adolescents and young adults including less experience driving, higher rates of drinking and driving, excessive speeding and lower rates of safety belt use. Given the significance of alcohol impaired driving to youth mortality, a key issue is the actions necessary to enhance the effectiveness of prevention policy and programming.

According to results illustrated in Table 4, the risk of injury was 4.66 higher among unrestrained occupants compared with restrained occupants. Entire body (OR 9.70; CI 5.88-15.9), head, face, nose, eye (OR 6.72; CI 5.37-8.41) and upper torso injuries (OR 5.71; CI 3.18-8.41) were the more common body sites injured in unrestrained occupants compared to restrained occupants. Likewise, fractures (OR 10.70; CI 7.35-15.5), lacerations (OR 7.50; 5.55-10.15) and concussions (OR 5.49; CI 2.71-11.12) were the more common types of injuries experienced by unrestrained occupants compared to restrained occupants.

Table 1 Risk of road traffic fatality among non restrained occupants compared withrestrained occupants in alcohol-related crashes in BC in 2003

Non-restrained	Restrained	OR	CI
38	36	4.70	2.99 - 7.58
597*	2,696*		

* No injuries

Table 2 Drinking drivers involved in alcohol-related collisions compared to all licensed drivers by age group

Age	Active licensed drivers	Percent of total driver population	Number of drivers involved in alcohol-related collisions	Percent of total drivers involved in alcohol-related collisions
16-20	187,806	6.62	347	17.30
21-25	224,672	7.92	421	20.64
26-35	496,801	17.51	451	22.11
36-45	618,523	21.80	432	21.18
46-55	580,326	20.46	254	12.45
56-65	376,255	13.26	95	4.65
66-75	228,304	8.05	24	1.18
76+	124,607	4.39	10	0.4

X^2 =610 P< .001

Table 3 Traffic fatalities by age and drinking driving

Alcohol involvement	<16	16-20	21-30	31-40	41-50	51-60	61-70	70+
Percentage of non alcohol related crashes	85%	69%	68.8%	64.6%	80%	73.7%	84%	95.5%
Percentage alcohol involved	15%	31%	31.2%	35.4%	20%	26.3%	16%	4.5%
Number of Alcohol involved	4	16	30	22	11	10	6	3
Total fatalities	27	52	96	62	55	38	38	67
Percentage of total drivers involved in alcohol related fatal collisions (%)	(4)	(15.7)	(29.5)	(21.5)	(10.7)	(9.8)	(5.8)	(3)

X^2 =136 P<.001

5. DISCUSSION

DWI by alcohol and failing to use occupant protection are two of the most significant risk factors for motor vehicle crash related injury and fatality on BC roads. The analysis demonstrated that, in drinking and driving crashes, the risk (OR) of fatal injury is 4.70 times higher among unrestrained occupants compared to restrained occupants (Table 1), while the risk of injury was 4.66 times higher among unrestrained occupants (Table 4). Entire body (OR 9.70), head, face, nose, eye (OR 6.72) and upper torso injuries (OR 5.17) were body sites more commonly injured in unrestrained occupants. Likewise, fractures (OR 10.70), lacerations (OR 7.50) and concussions (OR 5.49) were the more common types of injuries experienced by unrestrained occupants compared to the restrained occupants (Table 4).

Safety belt use is the single most effective strategy that can be employed to prevent deaths and injuries, and reduce costs associated with motor vehicle crashes. Traffic crashes are not only a grave public health problem for the province of BC, but also a significant economic burden. We need to develop, promote and implement effective educational, engineering, and enforcement programs aimed at ending preventable tragedies, and reducing the economic costs associated with motor-vehicle-related crashes. A similar study conducted in Minnesota, USA, found that drinking drivers were less likely to wear seat belts[27]. As those who were at greatest risk tended to be the least likely to wear seat belts, the study highlighted the value of passive seat belt restraints system, which may provide impetus to other creative and carefully focused interventions which target the high-risk drinking driver population in BC.

Table 4 Comparison of injury type in unrestrained occupants with restrained occupants in alcohol-related crashes in BC in 2003

Type of Injury	Unrestrained	Restrained	OR	CI
Abrasion	47	128	3.25	2.26-4.68
Bruises	63	171	3.26	2.37-4.50
Whiplash	26	125	1.84	1.18-2.87
Bleeding	62	77	7.14	4.97-10.26
Concussion	13	21	5.49	2.71-11.12
Lacerations	99	117	7.50	5.55-10.15
Fracture	70	58	10.70	7.35-15.5
Other	35	92	3.37	2.23-5.10
Total Injuries	415	789	4.66	3.88-5.60
No injuries	219	1,943		

6. RECOMMENDATIONS FOR THE PREVENTION OF ALCOHOL-IMPAIRED DRIVING

Traffic crashes are a leading cause of death for both adolescents and youth in BC, as demonstrated in this study. Strategies to reduce alcohol-impaired driving are strongly recommended. Continued efforts are recommended to deter the general public from drinking and driving, and renewed efforts to identify and intervene with specific age groups, such as young drivers whose levels of drinking and driving related fatal collisions are highest, are also recommended. A higher risk of crash among young drivers is attributed, in part, to their lack of driving experience, which renders them less able than more experienced drivers to cope with hazardous situations, even when they have not been drinking. When young drivers do drink and drive, they are more vulnerable than adults to the effects of alcohol on driving ability, in part due to their lack of driving experience. For all drivers, each 0.02 increase in BAC nearly doubles the risk of being involved in a fatal crash. For drivers ages 16-20, the risk of a fatal crash is even higher with each 0.02% rise in BAC. The estimated crash risk for male drivers ages 16-20 is at least three times higher than the risk for male drivers age 25 and older at all BAC levels[5].

6.1 Evidence based policies to reduce drinking and driving motor vehicle crashes

Previous systematic reviews indicate that several legislative and policy actions can be effective in reducing the number of alcohol-related crashes including: (a) laws establishing lower BAC levels; (b) more vigorous enforcement of minimum alcohol purchase age laws; (c) decreasing alcohol availability to youth; (d) carefully targeted multi-media community information, education campaigns; (e) extensive enforcement of nighttime driving restrictions; and, (f) passenger restriction policies for young novice drivers. The use of tax policy and availability controls to reduce alcohol-related problems has certain advantages. Such population-based measures are relatively easy to implement. The maintenance of alcohol taxes at levels indexed to inflation can be justified in terms of recovering the costs of alcohol to governments and society, and controls are clearly required for underage drinking and excessive promotion of alcohol. There is reasonably good evidence that these measures can reduce levels of drinking and alcohol-related problems[6].

BC traffic collision statistics shows that 33% of arrested drink-drive offenders are repeat offenders. These statistics suggest that drink-drive offenders, who have been convicted of more than one offence, would not only benefit from the application of sanctions, but also the opportunity to complete an appropriate intervention to address problem behavior(s), such as harmful alcohol consumption levels and the propensity to drive after drinking. It may prove essential to focus on resolving the underlying issues that directly influence the behavior such as alcohol misuse and/or dependence, rather than solely relying on traditional punitive approaches[28].

Wells-Parker, et al.[29], conducted a meta-analysis of remedial interventions with drink-drive offenders. The analysis established that DUI remediation generally has a positive effect on alcohol-related traffic events; an effect of at least a 7-9% reduction in DUI recidivism and alcohol crashes. Drinking and driving is a complex social, medical, and public health problem, and therefore only through a combination of legal, social, behavioral, environmental, and medical interventions we can expect to reduce drink-drive related deaths/injuries in BC. Furthermore, given the strong connection between repeat drink-drive offenders and drinking problems, support for the following is recommended: (a) adoption of effective interventions to reduce binge drinking, including comprehensive community-based programs; (b) screening and brief intervention for alcohol problems in clinical settings[30,31]; (c) installing highly visible sobriety checkpoints[32,33]; (d) alcohol-ignition interlock programs for repeat offenders; (e) vehicle impoundment programs; and, (f) support for sustained public education and enforcement. Using a combination of approaches is more likely to succeed than any single approach.

Deterrence theory indicates that the most effective combination is tough, fair laws, vigorous enforcement, and intensive and targeted educational campaigns[34-36]. However, laws by themselves are often not sufficient: the key factor in the effectiveness of a traffic law is motorists' perceptions that they run a high risk of being detected and punished for violating the law. The perception of likelihood of apprehension is a much stronger deterrent than the severity or the swiftness of the penalty. There is reasonably good evidence that a drivers' apprehensions of tough, fair laws can reduce levels of drinking and driving related problems.

6.2 Elimination of barriers of enforcement

Jonah et al.[37], found that the majority of Canadians consider impaired driving to be a serious problem that is socially unacceptable, and believe that it ought to be dealt with severely by the entire Criminal Justice System. However, a recent survey shows that police officers experience difficulties with the enforcement of impaired driving laws because of the inordinate amount of time it takes to process a charge; the frequency with which the accused is acquitted on what appear to some people to be legal technicalities; and, the increasing demands on officers for other services.

The American Automobile Association (AAA) Foundation for Traffic Safety has stated that the best way to address the problem of impaired driving is to strengthen the Criminal Justice System as a whole, and to recognize that simple solutions do not work[38]. The AAA study cited three strategies that would improve performance in the system: (a) better information sharing among system components; (b) better management of the overall system and the components; and, (c) increased funding devoted to the issue and all parts of the Criminal Justice System.

There is a clear need to review how the legal system deals with impaired driving in BC/Canada in order to determine how it could be streamlined to work more efficiently and effectively, and to reduce the frustration of police officers[37]. Improving the efficiency and effectiveness of the entire Criminal Justice System should result in reduced impaired driving and safer roads in BC/Canada. An aggressive law enforcement program, supported by strong laws and regulations, swift and sure consequences from the judiciary, and a strong prevention/education effort will result in changed community norms and change motorists behavior.

6.3 Cost effectiveness of mass media campaigns on drinking and driving

A recent systematic review[39], shows that mass media campaigns on drinking and driving reduce alcohol-related crashes in the period during or after the campaign (median decease: 13%; interquartile range [IQR] 6% to 14%). Mass media campaigns reduced crashes resulting in injury by a median of 10% (IQR 6% to 15%). Importantly, mass media campaigns resulted in large savings in medical costs, property damage and productivity (Victoria, Australia: campaign cost $403,174 per month versus savings of $8,324,532 per month; Wichita, USA: campaign cost $454,060 versus savings of $3,431,305; Kansas City, USA: campaign cost $322,660 versus savings of $3,676,399). Moreover, mass media campaigns are likely to have positive indirect effects, including an increase in public awareness and support for other road safety countermeasures. The review recommends paid advertising

campaigns over public service announcements in order to maintain control over placement and maximize exposure. Given the significant cost savings to society and the positive cost benefit, paid advertising campaigns to reduce drinking and driving should be seriously considered by policy makers in BC.

6.4 Effective strategies to increase seat belt use among drinking drivers is necessary

Canada has one of the highest rates of seat belt use in the world – the most recent survey of seat belt use in Canada found that 87.4% of front seat occupants of light-duty vehicles (i.e., passenger cars, pickup trucks, minivans and sport utility vehicles) buckle up. However, belt use by alcohol-impaired drivers is significantly lower than non-drinking drivers as indicated in this study. Therefore, the challenge of increasing seat belt use in high risk drivers (e.g. unrestrained drinking drivers) remains a public health priority. Legislation has made a major difference in increasing belt use, but legislation is not enough. As with alcohol-impaired drivers, there is a need for the implementation and evaluation of concentrated, innovative programs to increase seat belt use. Although seat belt usage has increased substantially over the past 20 years, considerable progress is needed to reach the goal of 95% by 2010 as set out in the National Occupant Restraint Program (NORP). The NORP is an important element of Road Safety Vision 2010 – an ambitious partnership approved by the federal, provincial and territorial ministers responsible for transportation and highway safety to make Canada's roads the safest in the world by the year 2010. BC is encouraged to increase fines for violations of the safety seat law and to expand coverage to every occupant in a motor vehicle.

6.5 Road Safety Vision 2010 in Canada

The overall target for Road Safety Vision 2010 in Canada is to decrease the average number of road users killed and seriously injured by 40% for 2010. Increasing seat belt use and child occupant protection are key initiatives to help achieve that target. Canada's Road Safety Vision 2010 recognizes the contribution of seat belt use and child safety seats to the reduction of traffic fatalities. However, further action is needed to increase the proper use of seat belts and thereby reduce the number of deaths and injuries on Canada's roads. Seat belts continue to save thousands of lives in BC/Canada and no other countermeasure can achieve the same level of savings. Enforcement, education and legislation are the three key elements needed to increase the appropriate use of motor vehicle restraint systems in our communities[40,41].

6.6 Evidence based policies to increase seat belt use

A recent meta analysis[42], has identified six main interventions to increase seat belt use by motor vehicle occupants as follows: (a) safety belt laws; (b) primary enforcement of these laws (that is, allowing police to stop and charge drivers for not wearing seat belts, as opposed to charging them only if they are stopped for other offences); (c) enhanced enforcement programs; (d) incentives; (e) mass media; and, (f) education programs. Perceptions of traffic laws and penalties probably are more important in influencing behavior than the actual laws and penalties. Because of this, some countries aggressively publicize their seat belt use laws and penalties[43].

Evaluation studies, summarized by Salzberg[44], show conclusively that high-visibility enforcement increases seat belt use and decreases vehicle occupant injuries. In addition, driver license demerit points may be a more severe sanction than fines, and may be effective in increasing seat belt use among vehicle drivers and occupants in BC. The principle of a demerit point system is that points accumulate and can lead to additional sanctions for repeated convictions, and ultimately license suspension or revocation. As a strategy to increase vehicle restraint use, BC could add additional provisions for the accumulation of demerit points which could have implications for the cost of insurance.

Previous Canadian research has shown that young drivers and passengers have the lowest rates of seat belt use[45]. Special measures may be effective for novice drivers, such as incorporating compulsory seat belt use in the BC Graduated Driver License program. Vehicle-based systems to increase seat belt use are also a viable option as the vehicle is programmed to take some action if occupants are not belted, ranging from brief warning lights or buzzers to a complete ignition interlock. The effect of level of enforcement can be seen in the results of Transport Canada's survey of seat belt use across the country, where dramatic decrease in enforcement have resulted in corresponding decline in the usage rates[40,41]. Efficient legislation, together with adequate surveillance of infringing behaviors, is essential to increase the number of road users who use safety equipment. Extensive enforcement of seat belt laws should result in increases in the proper use of safety devices which, in turn, then leads to decreased morbidity and mortality related to motor vehicle crashes in BC.

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ACKNOWLEDGEMENTS

We are grateful to the Insurance Corporation of British Columbia for permission to use the 2003 traffic collision statistics in British Columbia. We are pleased to thank the referees of this paper for their careful consideration and thoughtful comments.